

**JAPANESE**

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CLAIMS DETAILED DESCRIPTION TECHNICAL  
FIELD PRIOR ART EFFECT OF THE INVENTION  
TECHNICAL PROBLEM MEANS EXAMPLE

[Translation done.]

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## **DETAILED DESCRIPTION**

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the light polarizer protective film with which the use which protects the light polarizer of a polarizing plate is presented. It is related with the light polarizer protective film excellent in the optical property with few foreign matters in more detail.

[0002]

[Description of the Prior Art]Methods of processing thermoplastics into a film include a tubular film process, a calender molding method, a T-die melting extrusion method, etc. The T-die melting extrusion method is a film manufacturing method which extrudes melting resin from the T die which has a slit shape lip, fabricates to a sheet shaped, solidifies with a cooling roller, and is taken over,

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and since it can manufacture uniform thickness with sufficient accuracy, it is a method widely used as a manufacturing method of a film.

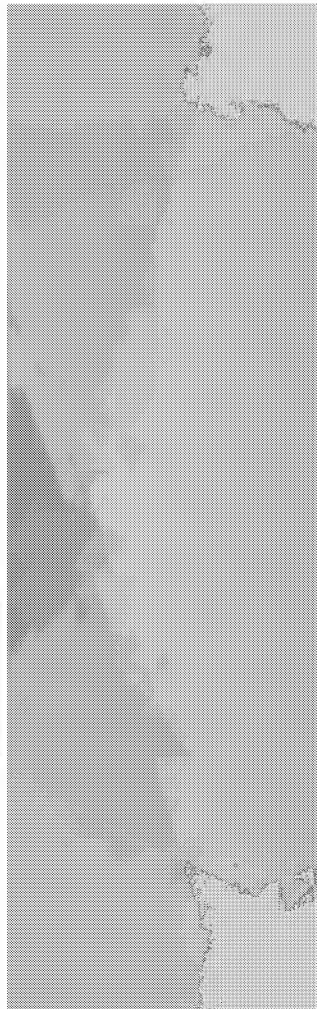
[0003]On the other hand, the optical film used for a liquid crystal display etc. is asked for the homogeneity of the double reflex within a field, and a light polarizer protective film is especially simultaneously asked also for a low double reflex with homogeneity so that a protective film may not reduce the polarizability of light polarizer. Film manufacturing methods with which such the characteristic that furthermore thickness accuracy is also required is obtained include the solution cast method. Although the shearing stress at the time of extrusion, etc. serve as a generation cause of a double reflex in a T-die melting extrusion method, it is because the solution cast method can control generating of a double reflex.

[0004]The thickness accuracy of the film manufactured by the solution cast method is still better than a T-die melting extrusion method. If the stretching process of the film manufactured with the T-die melting extrusion method is carried out, the film of thickness accuracy equivalent to the solution cast method can be obtained, but a stretching process increases the double reflex of a film.

[0005]In order that a T-die melting extrusion method may fuse resin by shear or overheating with an extrusion machine and may fabricate it on a film, it tends to generate foreign matters, such as a glow, in a grinding process. Moreover, since melt viscosity is very high unlike the solution cast method, high precision filtration is difficult.

[0006]Although the T-die melting extrusion method is advantageous in respect of cost or productivity in order not to use an organic solvent, it is based on the above reasons that the conventional light polarizer protective film has been manufactured by the solution cast method.

[0007]It is as follows if the influence of the foreign matter which exists in the optical film for liquid crystal displays is explanation. For example, when the liquid crystal display used for a mobile personal computer is taken for an example, a pixel number is 1024x768, and also the color picture element comprises 3 pixels of RGB. In this case, the size of monochrome matter becomes an equivalent for  $0.0002\text{-mm}^2$  on a 12.1-inch display. Although the foreign matter to 1/2 does not have visual influence in general to a



pixel, the foreign matter of the size beyond it serves as a defect on vision. For example, since a 50-micrometer foreign matter matches an area of 13 pixels in monochrome matter, if a 50-micrometer foreign matter recognizes 200-piece  $[\text{cm}]^2$  grade existence, it will cause generating with a defect of 1196000 pixels on a 12.1-inch display. Since it was such, development of a quality optical film with few foreign matters was desired.

[0008]

[Problem(s) to be Solved by the Invention] It is one of the issues which this invention tends to solve to provide the light polarizer protective film excellent in the optical homogeneity within a field with thickness accuracy to be a low double reflex and sufficient as above-mentioned. It is one of the issues which this invention tends to solve that the light polarizer protective film excellent in said characteristic can be provided even if it applies a T-die melting extrusion method. Even if it applies a T-die melting extrusion method, it is one of the issues which this invention tends to solve that a light polarizer protective film with few foreign matters can be provided.

[0009]

[Means for Solving the Problem] Wholeheartedly, as a result of examination, a light polarizer protective film which consists of a specific resin composition found out that it could become a solving means of an aforementioned problem, and this invention persons resulted in this invention which provides the following light polarizer protective films.

[0010] Namely, thermoplastics in which this invention has substitution or an unsubstituted imido group in the (A) side chain, And it consists of a resin composition which contains in the (B) side chain thermoplastics which has substitution or an unsubstituted phenyl group, and a nitrile group, When plane view is carried out, a size provides a light polarizer protective film, wherein a foreign matter more than  $0.0001\text{-mm}^2$  is below 920 pieces/ $460\text{cm}^2$ .

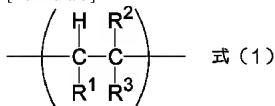
[0011] Said thermoplastics (A) has here a repeating unit expressed with a repeating unit expressed with a formula (1), and a formula (2), Content of a repeating unit of a formula (1) is 30 - 80-mol % on the basis of the total repeating unit of this thermoplastics (A) here, It is preferred that content of a repeating unit of a formula (2) is 70 - 20-



mol % on the basis of the total repeating unit of this thermoplastics (A), and said thermoplastics (B), It has a repeating unit expressed with a repeating unit expressed with a formula (3), and a formula (4), content of a repeating unit of a formula (3) is 20 to 50 % of the weight on the basis of the total repeating unit of this thermoplastics (B), and it is preferred that content of a repeating unit of a formula (4) is 50 to 80 % of the weight. It is preferred that content of this thermoplastics (A) is [ content of 55 to 75 % of the weight and thermoplastics (B) ] 25 to 45 % of the weight on the basis of the sum total of quantity of this thermoplastics (A) and quantity of thermoplastics (B).

[0012]

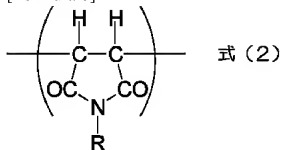
[Formula 5]



[0013](In a formula (1), R<sup>1</sup>, R<sup>2</sup>, and R<sup>3</sup> show hydrogen or the alkyl group of the carbon numbers 1-8 independently, respectively.)

[0014]

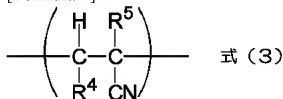
[Formula 6]



[0015](In a formula (2), R shows hydrogen, the alkyl group of the carbon numbers 1-18, or the cycloalkyl group of the carbon numbers 3-12.)

[0016]

[Formula 7]

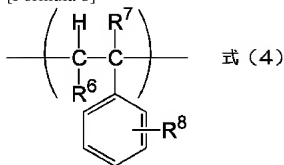


[0017](In a formula (3), R<sup>4</sup> and R<sup>5</sup> show hydrogen or the alkyl group of the carbon numbers 1-8 independently,

respectively.)

[0018]

[Formula 8]



[0019](R<sup>6</sup> and R<sup>7</sup> in a formula (4)) Independently, hydrogen or the alkyl group of the carbon numbers 1-8 is shown, respectively, and R<sup>8</sup>, Hydrogen, the alkyl group of the carbon numbers 1-8, a halogen group, a hydroxyl group, an alkoxy group, or a nitro group is shown. In other sides, the light polarizer protective film of this invention is characterized by being a T-die melting extruded film again. [0020]In other sides, the light polarizer protective film of this invention is characterized by being an oriented film.

[0021]

[Embodiment of the Invention]Hereafter, this invention is explained in detail. These are examples in this invention and do not limit this invention.

[0022](Resin) The film of this invention is made from the resin composition containing the thermoplastics which has substitution or an unsubstituted imido group in the (A) side chain, and the thermoplastics which has substitution or an unsubstituted phenyl group, and a nitrile group in the (B) side chain.

[0023]Into this specification, when the above-mentioned thermoplastics (A) is copolymer resin, this copolymer is also called "thermoplastic copolymer (A)." Into this specification, when the above-mentioned thermoplastics (B) is copolymer resin, this copolymer is also called "thermoplastic copolymer (B)."

[0024](Thermoplastics (A)) The thermoplastics (A) used for this invention is thermoplastics which has substitution or an unsubstituted imido group in a side chain. Here, the main chain of thermoplastics (A) may be a main chain of arbitrary thermoplastics. For example, it may be a main chain which consists only of carbon, or atoms other than carbon may be the main chains inserted between carbon. Or it may be a

main chain which consists of atoms other than carbon. Preferably, it is a main chain which consists only of carbon. For example, they may be hydrocarbon or its substitution product. Specifically, a main chain may be a main chain obtained by addition condensation. Specifically, they are polyolefine or polyvinyl.

[0025]A main chain may be a main chain obtained by a condensation polymerization. For example, it may be a main chain obtained by ester bond, an amide bond, etc.

[0026]Preferably, a main chain is a polyvinyl skeleton produced by polymerizing a substitution vinyl monomer.

[0027]As a method of introducing substitution or an unsubstituted imido group into thermoplastics (A), publicly known arbitrary methods are conventionally possible. For example, the thermoplastics which has substitution or an unsubstituted imido group may be obtained by polymerizing the monomer which has substitution or an unsubstituted imido group. For example, after polymerizing various monomers and forming a main chain, substitution or an unsubstituted imido group may be introduced into a side chain. For example, the graft of the compound which has substitution or an unsubstituted imido group may be carried out to a side chain.

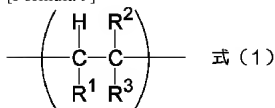
[0028]When the imido group is replaced by the substituent, as the substituent concerned, it is usable in the conventionally publicly known substituent which can replace hydrogen of an imido group. Specifically, it is an alkyl group etc.

[0029]Preferably, thermoplastics (A) is a copolymer (duality or plural copolymers beyond it) containing the repeating unit which has the repeating unit, at least one sort of substitution, or unsubstituted maleimide structure derived from at least one sort of olefins (alkene).

[0030]Thermoplastics (A) contains especially the repeating unit expressed with a following formula (1), and the repeating unit expressed with a following formula (2) preferably.

[0031]

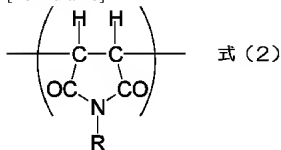
[Formula 9]



[0032](In a formula (1),  $R^1$ ,  $R^2$ , and  $R^3$  show hydrogen or the alkyl group of the carbon numbers 1-8 independently, respectively.) The carbon numbers of an alkyl group are 1-4 preferably, and are 1-2 more preferably.

[0033]

[Formula 10]



[0034](In a formula (2), R shows hydrogen, the alkyl group of the carbon numbers 1-18, or the cycloalkyl group of the carbon numbers 3-12.) The carbon numbers of an alkyl group are 1-4 preferably, and are 1-2 more preferably. Here, the content of the repeating unit of a formula (1) is 30 - 80-mol % on the basis of the total repeating unit of this thermoplastics (A) preferably. It is 40-60-mol % more preferably. It is 45-55-mol % still more preferably. The content of the repeating unit of a formula (2) is 20 - 70-mol % on the basis of the total repeating unit of this thermoplastics (A). It is 40-60-mol % more preferably. It is 45-55-mol % still more preferably. In a desirable embodiment, the sum of the repeating unit of a formula (1) and the repeating unit of a formula (2) is 100%. However, the 3rd repeating unit mentioned later may be used if needed.

[0035]When using the 3rd repeating unit, the 3rd repeating unit is less than 30 mol % preferably on the basis of the total repeating unit of a thermoplastic copolymer (A), is less than 20 mol % more preferably, is less than 15 mol % still more preferably, and is less than 10 mol % especially preferably. When there are too many 3rd repeating units, performance of a repeating unit expressed with the above-mentioned formula (1) and a repeating unit expressed with a formula (2) is fully hard to be obtained.

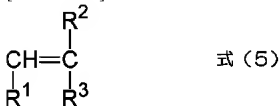
[0036]When using the 3rd repeating unit, the 3rd repeating unit is more than 1 mol % preferably on the basis of the total repeating unit of a thermoplastic copolymer (A), is more than 2 mol % more preferably, is more than 3 mol % still

more preferably, and is more than 5 mol % especially preferably. When there are too few 3rd repeating units, performance by the 3rd repeating unit is fully hard to be obtained as the whole constituent.

[0037] As for a ratio of a repeating unit of a formula (1), and a repeating unit of a formula (2), when using the 3rd repeating unit, it is preferred to consider it as the same ratio as a case where the 3rd repeating unit does not exist. [0038] (Repeating unit of a formula (1)) An olefin which provides a repeating unit (olefin unit) of a formula (1) is expressed with a following formula (5).

[0039]

[Formula 11]

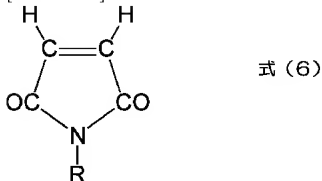


[0040] (Here, R<sup>1</sup>, R<sup>2</sup>, and R<sup>3</sup>) It is the same as a formula (1). If the desirable example of such an olefin is given, Isobutene, a 2-methyl-1-butene, 2-methyl-1-pentene, They are a 2-methyl-1-hexene, a 2-methyl-1-heptene, 1-isooctene, 2-methyl-1-octene, 2-ethyl-1-pentene, a 2-ethyl-2-butene, a 2-methyl-2-pentene, a 2-methyl-2-hexene, etc. These olefins may be used independently, or can be combined two or more sorts and can be used.

[0041] (Repeating unit of a formula (2)) The repeating unit (maleimide units) of the above-mentioned formula (2) can be derived from a corresponding maleimide compound. Such a maleimide compound is expressed with a following formula (6).

[0042]

[Formula 12]



[0043] (Here, R is the same as a formula (2).) If a desirable



example of such a maleimide compound is given, Maleimide and N-methylmaleimide, N-ethyl maleimide, N-n-propyl maleimide, N-i-propyl maleimide, N-n-butylmaleimide, N-i-butylmaleimide, N-s-butylmaleimide, N-t-butylmaleimide, N-n-pentylmaleimide, N-n-hexylmaleimide, N-n-heptylmaleimide, N-n-octylmaleimide, N-lauryl maleimide, N-stearyl maleimide, It is N-substitution maleimide, such as N-cyclo propyl maleimide, N-cyclo butylmaleimide, N-cyclopentylmaleimide, N-cyclohexylmaleimide, N-cycloheptyl maleimide, and N-cyclooctylmaleimide.

[0044] These maleimide compounds are independent or may be used combining two or more sorts. Especially as a maleimide compound, N-substitution maleimide (in a formula (6), R is bases other than hydrogen) is preferred. For example, it is N-methylmaleimide etc.

[0045] (The 3rd repeating unit) The thermoplastic copolymer (A) used for this invention can contain one or more sorts of other copolymeric monomers as the 3rd repeating unit in addition to the above-mentioned olefin unit and maleimide units. An acrylate monomer like [ such a copolymeric monomer ] methyl acrylate or butyl acrylate, A methacrylic-acid-ester monomer like methyl methacrylate or cyclohexyl methacrylate, An acid anhydride etc. which have vinyl monomers, such as vinyl ester monomers, such as vinyl acetate, and a vinyl ether monomer like the methyl vinyl ether, and an unsaturated double bond like a maleic anhydride are contained. These 3rd repeating units may be one kind of monomers, and are good also as the 3rd repeating unit combining two or more sorts of monomers. By making the 3rd repeating unit contain to such an extent that the optical characteristic is not spoiled, the heat resistance of a thermoplastic copolymer (A) can be raised, or a mechanical strength can be increased.

[0046] (Polymerization method of thermoplastic resin (A)) Thermoplastics (A) can be manufactured by polymerizing the above-mentioned olefin and a maleimide compound with a known polymerization method, for example. Graft polymerization is also included in this polymerization. Or thermoplastics (A) can polymerize the above-mentioned olefin and a maleic anhydride in accordance with a conventional method, can manufacture a precursor polymer, and can manufacture it also by making an amine compound

react to this and making a maleic anhydride part of a precursor polymer imide-ize. In that case, as an amine compound to be used, amine corresponding to an imide part in maleimide units of the above-mentioned formula (2) is contained. More specifically, it is formula:  $R-NH_2$  (however, R). It is the same as a formula (2). An amine compound expressed, for example, methylamine, Dimethylurea, diethylurea, etc. besides alkylamine, such as ethylamine, n-propylamine, i-propylamine, n-butylamine, sec-butylamine, tert-butylamine, and cyclohexylamine, or ammonia can be illustrated preferably. Also in this case, a copolymer which has a repeating unit of the above-mentioned formula (1) and a repeating unit of a formula (2) is obtained.

[0047] Thermoplastic copolymers (A) used for this invention may be any of a random copolymer, a block copolymer, a graft copolymer, and an alternating copolymer. It is preferred that it is an alternating copolymer. A thermoplastic copolymer (A) more preferably, As maleimide units, R in a formula (2) contains at least one sort of maleimide units which are the alkyl groups chosen from a methyl group, an ethyl group, an isopropyl group, and a cyclohexyl group, and them as an olefin unit,  $R^1$  in a formula (1) is hydrogen and  $R^2$  and  $R^3$  are the copolymers containing at least one sort of olefin units which are methyl groups, respectively. Here, in calling it a "unit" about a monomer in this specification, it says a thing of residue which remains after the monomer concerned polymerizes. Specifically, "maleimide units" means residue which remains after one used maleimide molecule polymerizes. Similarly, an "olefin unit" means residue which remains after one used olefin monomer polymerizes. [0048] Still more preferably, a thermoplastic copolymer (A) of this invention contains N-methyl maleimide units as maleimide units, and contains an isobutylene unit as an olefin unit. As for a thermoplastic copolymer (A) of this invention, it is preferred that it is especially an alternating copolymer of N-substitution maleimide and isobutene.

[0049] As for content of maleimide units, in a thermoplastic copolymer (A) of this invention, it is preferred that it is less than [ more than 30 mol % 80 mol % ] on the basis of the total repeating unit of a thermoplastic copolymer (A). When there is too little content of maleimide units or there is, there is a possibility that heat resistance and a mechanical strength

of a film which are obtained may be spoiled. [ too much ]  
Content of maleimide units is less than more than 40 mol %  
60 mol % more preferably.

[0050]The remainder of a repeating unit in a thermoplastic copolymer (A) is an olefin unit. A thermoplastic copolymer (A) has especially a preferred thing for which maleimide units and an olefin unit are included as the main ingredients. In one embodiment, the sum total of maleimide units and an olefin unit is more than [ of an in / a thermoplastic copolymer (A) ] 50 mol %, and is more than 70 mol % preferably. More preferably, it is more than 80 mol %, and is more than 90 mol % still more preferably.

[0051]As for a thermoplastic copolymer (A), it is preferred to have the weight average molecular weight more than  $1 \times 10^4$ .

[0052]As for a thermoplastic copolymer (A), it is preferred to have the weight average molecular weight below  $5 \times 10^5$ .

[0053]As for a thermoplastic copolymer (A), it is preferred that glass transition temperature is preferred and not less than 80 °C of heat resistance [ not less than 100 °C of ] which is not less than 130 °C still more preferably is shown more preferably.

[0054]An olefin maleimide copolymer used for this invention, It can obtain by a method which can manufacture by a method of itself known like previous statement, for example, is indicated to JP,5-59193,A, JP,5-195801,A, JP,6-136058,A, and JP,9-328523,A.It can manufacture by carrying out copolymerization of an olefin and the maleimide compound directly, or carrying out the graft copolymerization of another side to polymer of one of these, or making an amine compound react to a precursor polymer mentioned above, and specifically introducing imide bonding.

[0055](Thermoplastics (B)) Thermoplastics (B) used for this invention is thermoplastics which has substitution or an unsubstituted phenyl group, and a nitrile group in a side chain. Here, a main chain of thermoplastics (B) may be a main chain of arbitrary thermoplastics. For example, it may be a main chain which consists only of carbon, or atoms other than carbon may be the main chains inserted between carbon. Or it may be a main chain which consists of atoms other than carbon. Preferably, it is a main chain which consists only of carbon. For example, they may be

hydrocarbon or its substitution product. Specifically, a main chain may be a main chain obtained by addition condensation. Specifically, they are polyolefine or polyvinyl.

[0056]A main chain may be a main chain obtained by a condensation polymerization. For example, it may be a main chain obtained by ester bond, an amide bond, etc.

[0057]Preferably, a main chain is a polyvinyl skeleton produced by polymerizing a substitution vinyl monomer.

[0058]As a method of introducing substitution or an unsubstituted phenyl group into thermoplastics (B), publicly known arbitrary methods are conventionally possible. For example, thermoplastics may be obtained by polymerizing a monomer which has substitution or an unsubstituted phenyl group. For example, after polymerizing various monomers and forming a main chain, substitution or an unsubstituted phenyl group may be introduced into a side chain. For example, the graft of the compound which has substitution or an unsubstituted phenyl group may be carried out to a side chain.

[0059]When a phenyl group is replaced by a substituent, as the substituent concerned, it is usable in a conventionally publicly known substituent and replacement positions which can replace hydrogen of a phenyl group. Specifically, a substituent is an alkyl group etc., for example.

[0060]As a method of introducing a nitrile group into thermoplastics (B), publicly known arbitrary methods are conventionally possible. For example, thermoplastics which has a nitrile group may be obtained by polymerizing a monomer which has a nitrile group. For example, a nitrile group may be introduced into a side chain, after polymerizing various monomers and forming a main chain. For example, the graft of the compound which has a nitrile group may be carried out to a side chain.

[0061]Thermoplastics (B) used for this invention is a copolymer (duality or plural copolymers of 3 yuan or more) which includes preferably a repeating unit (nitril unit) derived from an unsaturated nitrile compound, and a repeating unit (styrene system unit) derived from a styrene system compound.

[0062](Nitril compound) If a desirable example of an unsaturated nitrile compound which constitutes the above-mentioned desirable copolymer (B) is given, It is a nitril

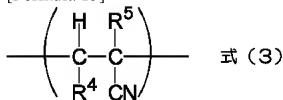
compound which has alpha like alpha-substitution unsaturated nitrile like acrylonitrile or a methacrylonitrile, and fumaronitrile, and beta-disubstituted olefin nature unsaturated bond.

[0063](Styrene system compound) As a styrene system compound which constitutes the above-mentioned desirable copolymer (B), Unsubstituted [, such as styrene, vinyltoluene, methoxy styrene or chlorostyrene, ] or a substitution styrene system compound, and alpha-substitution styrene system compounds, such as alpha-methylstyrene, can be used.

[0064]In a desirable embodiment, thermoplastics (B) has a repeating unit expressed with a repeating unit expressed with a formula (3), and a formula (4).A repeating unit of a formula (3) is preferred on the basis of a repeating unit in thermoplastics (B), and it is 20 to 50 % of the weight, is 20 to 40 % of the weight more preferably, and is 20 to 70 % of the weight still more preferably.

[0065]

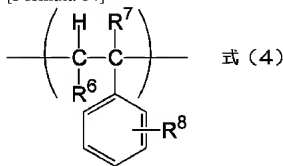
[Formula 13]



[0066](In a formula (3), R<sup>4</sup> and R<sup>5</sup> show hydrogen or the alkyl group of the carbon numbers 1-8 independently, respectively.) The carbon numbers of an alkyl group are 1-4 preferably, and are 1-2 more preferably.

[0067]

[Formula 14]



[0068](In a formula (4), R<sup>6</sup> and R<sup>7</sup> show hydrogen or the alkyl group of the carbon numbers 1-8 independently, respectively, and R<sup>8</sup> shows hydrogen, the alkyl group of the carbon numbers 1-8, a halogen group, a hydroxyl group, an

alkoxy group, or a nitro group.) The carbon numbers of an alkyl group are 1-4 preferably, and are 1-2 more preferably. In a formula (4), the carbon numbers of an alkyl group are 1-8, and are 1-3 preferably. In a formula (4), preferably, it is 1-20, and the carbon numbers of an alkoxy group are 1-8, and are 1-4 still more preferably.

[0069]A repeating unit of a formula (4) is preferred on the basis of the total repeating unit in thermoplastics (B), and it is 50 to 80 % of the weight, is 60 to 80 % of the weight more preferably, and is 70 to 80 % of the weight still more preferably. In one desirable embodiment, the sum of a repeating unit of a formula (3) and a repeating unit of a formula (4) is 100%. However, the 3rd repeating unit mentioned later may be used if needed.

[0070]When using the 3rd repeating unit, the 3rd repeating unit is 30 or less % of the weight preferably on the basis of weight of a thermoplastic copolymer (B), is 20 or less % of the weight more preferably, is 15 or less % of the weight still more preferably, and is 10 or less % of the weight especially preferably. When there are too many 3rd repeating units, performance of a repeating unit expressed with the above-mentioned formula (3) and a repeating unit expressed with a formula (4) is fully hard to be obtained.

[0071]When using the 3rd repeating unit, the 3rd repeating unit is 1 % of the weight or more preferably on the basis of weight of a thermoplastic copolymer (B), is 2 % of the weight or more more preferably, is 3 % of the weight or more still more preferably, and is 5 % of the weight or more especially preferably. When there are too few 3rd repeating units, performance by the 3rd repeating unit is fully hard to be obtained as the whole constituent.

[0072]As for a ratio of a repeating unit of a formula (6), and a repeating unit of a formula (7), even if it is a case where the 3rd repeating unit is used, it is preferred to use the same ratio as a case where the 3rd repeating unit does not exist.

[0073](The 3rd repeating unit) A thermoplastic copolymer (B) may contain other copolymeric monomers as a third component in addition to the above-mentioned nitril unit and a styrene system unit. Preferably, olefin system monomers, such as acrylic monomers, such as butyl acrylate, ethylene, and propylene, are contained in such a third component, and the flexibility of a film obtained in these monomers by carrying out copolymerization of one

sort or the two sorts or more can be raised to it. As a third component, N-substitution maleimide can also be used and the heat resistance of the copolymer concerned can be raised by using this N-substitution maleimide, especially phenylmaleimide as a copolymer component.

[0074](Polymerization method of thermoplastics (B))

Although a thermoplastic copolymer (B) is obtained by carrying out copolymerization of these monomers directly, it may carry out the graft copolymerization of another side to either a polymer of a styrene system compound, or a polymer of an unsaturated nitrile compound. A desirable copolymer can be obtained by carrying out the graft polymerization of a styrene system compound and the unsaturated nitrile system compound to an acrylic polymer which has rubber elasticity.

[0075]Especially a desirable thermoplastic copolymer is a copolymer which contains acrylonitrile as an unsaturated nitrile ingredient and contains styrene as a styrene system ingredient. These copolymers are known as an AS resin or AAS resin.

[0076]In a thermoplastic copolymer (B), a ratio of an unsaturated nitrile unit and a styrene system unit is preferred, the former is 20 to 50 % of the weight, the latter is 50 to 80 % of the weight, more preferably, the former is 20 to 40 % of the weight, and the latter is 60 to 80 % of the weight. Especially when the former is [ the latter ] 70 to 80 % of the weight at 20 to 30 % of the weight, a still more desirable result is given. If an ingredient of a styrene system compound or a nitrile system compound exceeds this range, compatibility with thermoplastics of (A) becomes scarce, the transparency of a film obtained falls, Hays becomes large, and it is not desirable.

[0077]A thermoplastic copolymer (B) has especially a preferred thing for which an unsaturated nitrile unit and a styrene system unit are included as the main ingredients. It is preferred that the sum total of an unsaturated nitrile unit and a styrene system unit is 70% of the weight or more of a thermoplastic copolymer (B). More preferably, it is 80 % of the weight or more, is 90 % of the weight or more still more preferably, and is 95 % of the weight or more especially preferably. Of course, it is good also as 100 % of the weight.

[0078]A thermoplastic copolymer (B) has especially a preferred thing for which an unsaturated nitrile unit and a

styrene system unit are included as the main ingredients (the sum total of an unsaturated nitrile unit and a styrene system unit is 70% of the weight or more of a thermoplastic copolymer (B) preferably).

[0079]As for a thermoplastic copolymer (B), it is preferred to have the weight average molecular weight more than  $1 \times 10^4$ .

[0080]As for a thermoplastic copolymer (B), it is preferred to have the weight average molecular weight below  $5 \times 10^5$ .

[0081](Thermoplastics (A) and ratio with (B)) As for a ratio of thermoplastics (A) and thermoplastics (B) which are used in order to obtain an oriented film of this invention, it is preferred to blend to 10 to 90 % of the weight of thermoplastics (A) at a rate of 10 to 90 % of the weight of thermoplastics (B). It is more preferred to blend to 50 to 80 % of the weight of thermoplastics (A) at a rate of 20 to 50 % of the weight of thermoplastics (B). It is still more preferred to blend to 55 to 75 % of the weight of thermoplastics (A) at a rate of 25 to 45 % of the weight of thermoplastics (B), and especially a rate of 30 to 45 % of the weight of thermoplastics (B) is preferred to 55 to 70 % of the weight of thermoplastics (A).

[0082]When thermoplastics (B) separated from a desirable range and an oriented film is used, there is a possibility that phase contrast of a plane direction or a thickness direction may become large. If there are too many compounding rates of thermoplastics (B), the transparency of a film obtained will fall easily.

[0083]By blending both the resin (A) and (B) at an above-mentioned rate, it can be considered as an oriented film in which phase contrast is very small in both a plane direction of a film, and a thickness direction.

[0084]In a desirable embodiment, the sum of thermoplastics (A) and thermoplastics (B) is 100 % of the weight.

[0085]Desirable composition ratio which shows such the characteristic is dependent on a kind of thermoplastics (A) and thermoplastics (B). a ratio (I/P ratio) of the number I of imido group mols contained in the thermoplastics (A) and (B) to the phenyl group mol P [ several ] generally contained in the thermoplastics (B) and (A) to be used -- 0.7-2.9 -- more -- desirable -- 0.9-2.6 -- still more preferably, Choosing composition ratio of thermoplastics (A) and thermoplastics (B) so that it may be set to 1.0-2.4 chooses a



mutual polymer of desirable N-methylmaleimide and isobutene as thermoplastics (A), Thermoplastics (A) at the time of choosing a copolymer of acrylonitrile and styrene as thermoplastics (B): As for a weight ratio of thermoplastics (B), 50:50-75:25 are preferred, and 55:45-70:30 are more preferred. As for quantity of an acrylonitrile ingredient in thermoplastics (B), 20 to 30 % of the weight is preferred, and its 25 to 29 % of the weight is more preferred.

[0086]By making \*\*\*\*\* selection of the desirable presentation which was mentioned above, an oriented film in which a double reflex is not shown substantially can be obtained. For example, phase contrast (product of a double reflex and thickness) of a plane direction of a film can control by a desirable embodiment to 10 nm or less, and it can control by a still more desirable embodiment to 6 nm or less. For example, phase contrast of a film thickness direction can control to 50 nm or less, and it can control by a more desirable embodiment to 20 nm or less. It is especially controllable by a desirable embodiment to 10 nm or less. Phase contrast of a plane direction of a film can estimate that there is generally no double reflex substantially, when phase contrast of a thickness direction of 10 nm or less and a film is 50 nm or less.

[0087]If a desirable presentation mentioned above is chosen suitably, simultaneously with the above-mentioned double reflex performance, an unstretched film with low Hays and an oriented film can be obtained highly [ light transmission ]. Concrete for example, in the desirable embodiment, not less than 85% of film is easily obtained for light transmission, and not less than 88% of film may be obtained in a more desirable embodiment. Hays may be controlled by a desirable embodiment to 2% or less, and it may be controlled by a more desirable embodiment to 1% or less. It may be especially controlled by a desirable embodiment to 0.5% or less. If it is a film whose light transmission is not less than 85% and whose Hays is 2% or less, it can be used as a highly efficient film of various optical applications.

[0088](Additive agent) A resin composition of these may contain publicly known additive agents, such as a plasticizer, a thermostabilizer, a processability improving agent, an ultraviolet ray absorbent, and a filler, and other resin if needed.

[0089]Especially since there is a tendency for resistance to become high, in the case of filtration when melt viscosity of a thermoplastic resin composition is high, melt viscosity can fall, a filter can split and \*\*\*\*\* can be prevented if a small amount of plasticizers and lubricant are added, it is effective. As such a plasticizer, it is conventionally usable in a publicly known plasticizer. For example, phosphoric ester system plasticizers, such as aliphatic-dibasic-acid system plasticizers, such as adipic acid di-n-decyl, and tributyl phosphate, etc. may be illustrated.

[0090](Manufacture of a film) It will be divided into a polymerization process of thermoplastics (A) and thermoplastics (B), a process of obtaining a resin composition which carries out kneading distribution of resin, the additive agent, etc. uniformly, and is used for shaping, and a process fabricated on a film if a manufacturing method of a light polarizer protective film of this invention is divided roughly.

[0091]In a polymerization process, it filters if needed after each polymerization of thermoplastics (A) and thermoplastics (B), and gel, a foreign matter, etc. are removed.

[0092]In a process of obtaining a resin composition, mixture dispersion of the additive agent is uniformly carried out with an extrusion machine etc. thermoplastics (A), thermoplastics (B), and also if needed, and a pellet is created. When product tampering is taken into consideration, the single screw extruder is more preferred than a twin screw extruder.

[0093]It is more desirable to carry out a design of a screw to composition which can attain distribution and mixing, and it can illustrate a design etc. which have arranged a high compression ratio and a dull mage double. A filtration system using a stainless steel fiber sintering filter about removal of a foreign matter in this process is preferred.

[0094]A pellet is uniformly fused with an extrusion machine and a film is fabricated in a process fabricated on a film by T-die melting extrusion. At this time, when a gear pump is introduced, instability of regurgitation can be canceled and it is desirable. A filtration system using a stainless steel fiber sintering filter about removal of a foreign matter in this process is preferred.

[0095](Filtration system) As for a filtration system, it is more preferred to use by every place of a resin

polymerization process, distribution, a mixing process, and a film forming cycle.

[0096]A term in this specification : with a stainless steel fiber sintering filter. a stainless steel fiber object be involved intricately -- \*\* -- specifically, it is what can compress after making the state where it became entangled like wool yarn or cotton, is what sintered a contact place and was unified, changes density with thickness and a compression amount of the textiles, and can adjust filtration accuracy -- further -- filtration accuracy -- rough \*\* -- it uses that it is dense with a multilayer object repeated two or more times continuously. It is preferred to use such a stainless steel fiber sintering filter as a filtration system.

[0097]Since removal ability of a foreign matter can be improved from an upper part of a river of a process to a lower part of a river that a foreign matter which escaped from a channel it is denser to repeat rough \*\* \*\* of filtration accuracy stagnates in rough \*\*\*\* space, and it is hard to produce penetration to the next dense channel rather than raising filtration accuracy one by one, it is desirable. rough \*\* -- it is more preferred to increase a dense repeating unit and removal ability of a foreign matter increases further in this case.

[0098]It is removable by using this filtration system also about a gel thing and the shape of a string which are made difficult [ removal ].

[0099](Extension) An unstretched film obtained from thermoplastics (A) and thermoplastics (B) usually has a low mechanical strength in many cases. \*\*\*\*\*-proof which expresses endurance to repeated crookedness especially is about 10 or less times in many cases. Tear propagation strength is also 100 to 120 gf/about mm in many cases. For this reason, a double-width unextended film is slightly disadvantageous in respect of industrial handling nature. However, this invention persons found out that these mechanical strengths were improved substantially by extending a film. Phase contrast does not become large, even after in such a presentation extending and tearing a film and improving propagation strength and \*\*\*\*\*-proof. For this reason, it is one of the especially desirable embodiments of this invention to extend a film which has thermoplastics (A) and thermoplastics (B).

[0100]Extension of a film will improve the characteristic of

\*\*\*\*\*-proof to bending to the extension direction.

Extension of a film will improve tear propagation strength to a direction which intersects perpendicularly to the extension direction. Therefore, in a roll like film, when a film with which tear propagation strength of a film width direction has been improved is required, generally, it is preferred to perform vertical extension. When improving tear propagation strength of a machine direction (longitudinal direction) of a film, it is preferred to perform lateral orientation. In order to improve in both directions, it is preferred to perform biaxial stretching. Biaxial stretching may be biaxial stretching one by one, or may be simultaneous biaxial stretching. Since the simultaneous biaxial stretching can improve these mechanical properties uniformly at a film flat surface, it is especially preferred. If phase contrast by each extension is offset by adjusting extension of both directions in the case of biaxial stretching, it is possible to suppress phase contrast within a field still lower.

[0101]As an extension method, publicly known arbitrary extension methods are conventionally employable. A hot stretching method is preferred. It may be uniaxial stretching or may be biaxial stretching. Compared with conventional polycarbonate, phase contrast cannot reveal thermoplastics (A) and a film using (B) easily at the time of extension. Therefore, generally draw magnification is made larger than a case where conventional polycarbonate is extended. Therefore, vertical uniaxial stretching which large draw magnification can realize easily is preferred.

[0102]It is also possible to give special biaxial stretching as shown in JP,5-157911,A, and to control a refractive index in three dimensions of a film.

[0103]Value optimal as an index can be used for extension temperature and draw magnification for tear propagation strength of an obtained film. Generally, as for draw magnification, it is preferred that they are 3 times from 1.1 times. They are 1.3 times - 2.5 times more preferably. They are 1.5 times - 2.3 times still more preferably.

[0104]If thermoplastics (A) and thermoplastics (B) are in an already described desirable composition range, it is possible by choosing relevant extension conditions to extend a film, without reducing light transmission, Hays, etc. substantially. 1.3 or more times, by extending 1.5 or more times especially



more preferably, tear propagation strength, \*\*\*\*\*-proof, etc. of a film are improved substantially, light transmission is high (for example, not less than 85%), and a film with small (for example, 1% or less) Hays can be obtained.

[0105]Temperature at the time of extending is preferably chosen in the range from \*\* (Tg-30) (Tg+30) to \*\* by setting to Tg glass transition temperature of a film for which it asked by the DSC method. Especially a desirable extension temperature is a range from \*\* (Tg-20) (Tg+20) to \*\*. By extending in a suitable temperature requirement, a film white blush mark at the time of extension can be decreased or prevented. Double reflex variation of an obtained film can be made small. When extension temperature is too high, it is easy to become insufficient improving [ which was obtained ] of tear propagation strength of a film or \*\*\*\*\*-proof. There is a possibility that draw magnification may become excessive too much and industrial operation may become difficult. On the contrary, when it extends at too low a temperature, Hays of an oriented film becomes large easily. In being extreme, it is easy to cause a problem of processes, like a film splits.

[0106]The extending method which combined vertical extension using lateral orientation and a roll using a tenter as a method of extension, free Masakazu axis extension, and these one by one biaxial stretching, simultaneous biaxial stretching which extends length and width simultaneously, etc. are publicly known one by one can be used.

[0107]Phase contrast of a plane direction of a film of a film which is obtained by a method mentioned above and which does not have phase contrast (product of a double reflex and thickness) substantially is less than 20 nm. A film substrate for plastic liquid crystal displays, etc. will become the cause by light leakage which originated in phase contrast in a liquid crystal display that contrast is poor, easily, if phase contrast of a plane direction of a film exceeds 20 nm in a use of a film which does not have phase contrast substantially. Phase contrast of a plane direction of a film is 10 nm or less more preferably, and is 5 nm or less still more preferably. 200 nm or less of phase contrast of a thickness direction is 100 nm or less preferably, and 50 nm or less of light polarizer protective films of this invention are 25 nm or less still more preferably more preferably.

[0108]A stretching process to a film is effective in reducing



the foreign matter number per unit area of a film. However, in the conventional resin composition, by a stretching process, phase contrast became large and was not able to apply as a foreign matter reducing method of a light polarizer protective film. On the other hand, the light polarizer protective film of this invention can reduce the foreign matter number also by a method by a stretching process, in order to use a resin composition which phase contrast does not reveal substantially.

[0109](Foreign matter number in a film) When plane view of the foreign matter number in a light polarizer protective film is carried out, a foreign matter more than  $0.0001\text{-mm}^2$  has [ 920 pieces/below  $460\text{cm}^2$  ] a size preferred [ the number ]. 500 pieces/below  $460\text{cm}^2$  is below 200 pieces/ $460\text{cm}^2$  still more preferably more preferably. Usually, since a light polarizer protective film is pasted together by both sides of a polarizing plate and two polarizing plates are used for a liquid crystal display, emitted light from a liquid crystal display passes a light polarizer protective film of four sheets as the whole. For this reason, the foreign matter number in a light polarizer protective film has great influence on a display defect compared with other optical members, and when it deviates from the above-mentioned range, there is a possibility of reducing display quality of a liquid crystal display greatly.

[0110]

[Example]This invention is explained according to an example below.

[0111](Property measuring method) The example of this invention is described below. Before explaining the concrete contents of the example, the measuring method of each property value shown as each experimental result is shown below first.

[0112]It measured using the sensing pin type continuation film thickness meter by <thickness measuring method> ANRITSU CORP. (film SHIKKUNESU circuit tester KG601B and electronic comparator K3001A). The thickness of the film started in the cross direction and the length direction of a film except for 50 mm at 30 mm in width and not less than 200 mm in length, respectively from the both ends of the cross direction of a film was measured continuously. Thickness unevenness was made into the maximum of thickness, and the difference of the minimum.



[0114]It measured with the measured wavelength of 514.5 nm using the <phase contrast of plane direction> micro polarization spectrophotometer (ORC Manufacturing: TFM-120AFT).

[0114]Using a <phase contrast of thickness direction> micro polarization spectrophotometer (ORC Manufacturing: TFM-120AFT), the angular dependence of phase contrast is measured with the measured wavelength of 514.5 nm, and  $n_x$ ,  $n_y$ , and  $n_z$  are calculated. The thickness of the film was measured separately and the phase contrast of the thickness direction was calculated using the lower type.

[Phase contrast of a thickness direction] The unevenness of  $= (n_x + n_y) / 2 - d [n_z] \times$  <unevenness of phase contrast> phase contrast measured five or more phase contrast of the place distant 1 cm, and made it the difference of the maximum and minimum.

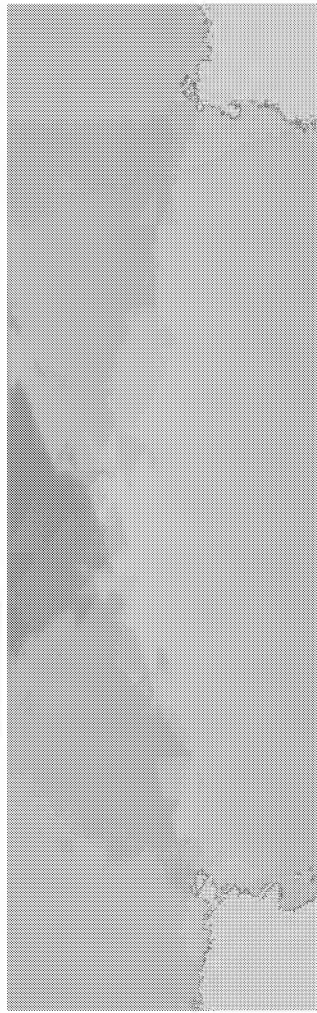
[0115]It measured based on <glass-transition-temperature> JIS K7121.

[0116]It measured using 550-nm light by the method of 5.5 statements of <light transmission> JIS K7105-1981.

[0117]It measured by the method of 6.4 statements of <Hays> JIS K7105-1981.

[0118](Example 1) Isobutene and alternating copolymer (N-methylmaleimide content %, glass transition temperature of 157 \*\* of 50 mol) 65 weight section which comprises N-methylmaleimide (distribution, mixing process), After the content of acrylonitrile blended acrylonitrile styrene copolymer 35 weight section and 0.1 copy of zinc stearate which are 27 % of the weight, it carried out melting kneading at 260 \*\* using a 40-mm single screw extruder, and the pellet distributed and mixed uniformly was obtained. The stainless steel fiber sintering filter (Nippon Seisen [ Co., Ltd. ] make: NF series) which consists of a multilayer object in which it is a thing of the filtration accuracy whose coarser portions are 100 micrometers of nominal value, and the filtration accuracy whose dense portions are 60 micrometers of nominal value, and five layers of thickness of each class have arranged about 0.5 mm by turns was used for the filtration system.

[0119](Film shaping) After drying the pellet distributed and mixed uniformly at 120 \*\* for 3 hours or more, it extruded at 270 \*\* using the T die of 400-mm width with a 40-mm single screw extruder, sheet shaped melting resin was



cooled on the cooling drum, and the film of about 300-mm width was obtained.

[0120]The stainless steel fiber sintering filter (Nippon Seisen [ Co., Ltd. ] make: NF series) which consists of a multilayer object in which it is a thing of the filtration accuracy whose coarser portions are 100 micrometers of nominal value, and the filtration accuracy whose dense portions are 40 micrometers of nominal value, and five layers of thickness of each class have arranged about 0.5 mm by turns was used for the filtration system.

[0121](Evaluation) As a result of scanning the obtained film in 300 times as many micro high-speed-steel Co-ops and counting the number of foreign matters, the number of the foreign matter more than  $0.0001\text{-mm}^2$  was 40 pieces/460cm<sup>2</sup>. When the obtained film was included in a 12.1-inch liquid crystal display and defect inspection by vision was carried out, the defective part was about 20 pieces and it was a level which is substantially satisfactory.

[0122]The average thickness of this film was 150 micrometers, thickness nonuniformity was 3 micrometers, and, as for the unevenness of 2 nm and phase contrast, the unevenness of 3 nm and phase contrast of the average of the phase contrast of 1 nm or less and a thickness direction was [ the average of the phase contrast of a plane direction ] 1 nm or less. The fluorescent lamp looked very clear, when what faced across both sides of light polarizer with these films is arranged at 2 degrees [ 45 ] and the fluorescent lamp was observed. Hays of the film was 138 \*\* in glass transition temperature 0.4%.

[0123](Extension) After preheating at 145 \*\* with the preheating roll of a vertical drawing machine, it once cooled at 143 \*\*, and the film created above was extended 1.8 times with an extension roll. Subsequently, after preheating at 147 \*\* in the preheating zone of a tenter, it extended 1.8 times in 145 \*\* stretching zones, and the biaxially oriented film was obtained one by one.

[0124]The average thickness of this film was 45 micrometers, thickness nonuniformity was 2 micrometers, and, as for the unevenness of 2 nm and phase contrast, the unevenness of 3 nm and phase contrast of the average of the phase contrast of 1 nm or less and a thickness direction was [ the average of the phase contrast of a plane direction ] 1 nm or less. The fluorescent lamp looked very clear, when





what faced across both sides of light polarizer with these films is arranged at 2 degrees [ 45 ] and the fluorescent lamp was observed. Hays of the film was 138 \*\* in glass transition temperature 0.4%.

[0125]The foreign matter number is 27 pieces/460cm<sup>2</sup>, and was decreasing rather than extension before.

[0126]( Comparative example)

(Distribution, mixing process) The pellet was obtained with the same resin composition as Example 1. However, the screen piled-up in order of 40 meshes, 400 meshes, 60 meshes, and 40 meshes was used for the filtration system.

[0127](Film shaping) The film of about 300-mm width was obtained using the same T die as Example 1. However, the filter which consists of a laminated material of a metal fiber sintered compact and a metallic powder sintered compact was used for the filtration system. \*\*\*\*\* of a metal fiber sintered compact -- as for 3 mm and \*\*\*\*\* of a metallic powder sintered compact, in thickness, thickness used a 2-mm thing at 40 micrometers by 60 micrometers.

[0128](Evaluation) As a result of scanning the obtained film in 300 times as many micro high-speed-steel Co-ops and counting the number of foreign matters, the number of the foreign matter more than 0.0001-mm<sup>2</sup> was 2000 pieces/460cm<sup>2</sup>. When the obtained film was included in a 12.1-inch liquid crystal display and defect inspection by vision was carried out, the defective part was about 400 pieces and that coloring nonuniformity is worrisome in a white background etc. was a level which has a problem visually.

[0129]

[Effect of the Invention]the light polarizer protective film of this invention has the good homogeneity within a field of an optical property -- the product of a double reflex and thickness -- a table -- phase contrast is very small and thickness accuracy is [ the bottom ] good. Since a T-die melting extrusion method and stretching treatment are applicable, improvement in productivity is brought to manufacture of the light polarizer protective film of this invention. The light polarizer protective film of this invention can provide the liquid crystal display with them which has few foreign matters used as vision top trouble. [ quality ]

[Translation done.]